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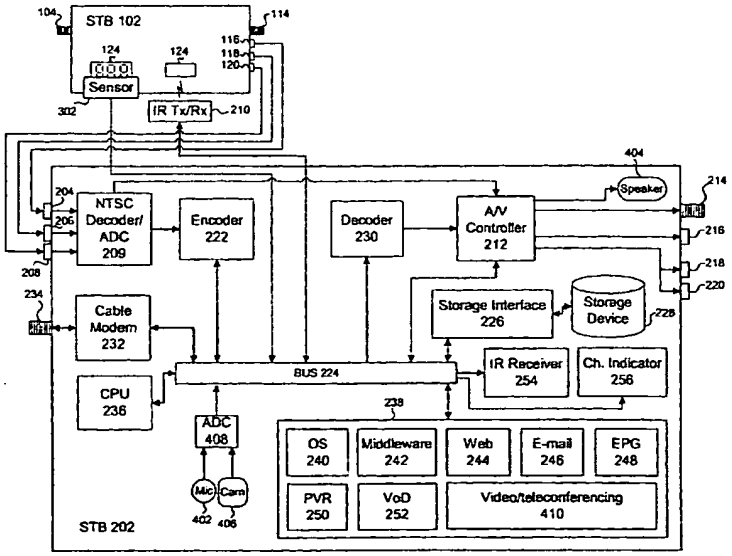

(57) Abstract: A companion device (STB 202) provides enhanced features to a standard set top box (STB 102), such as Internet access, Video-on-Demand (VoD), E-mail, an Electronic Programming Guide (EPG), Personal Video Recording (PVR), video/teleconferencing, and the like, all without retrofitting or replacing the STB (STB 102). The companion device may include, for instance, a cable modem (232), a storage device (228), an encoder (222), a decoder (230), a remote control simulator, a channel-change sensor, and a various software modules, such as a Web browser (244), an E-mail client (246), an EPG client (248), a PVR module (250), a VoD module (252), and a video/teleconferencing module (410).

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERACTIVE COMPANION SET TOP BOX

BACKGROUND

Related Applications

The present application is related to and claims priority from U.S. Patent Application No. 60/254,011, entitled "Interactive Companion Set Top Box," filed December 7, 2000, with inventors Ted M. Tsuchida and James A. Billmaier, which is incorporated herein by reference in its entirety.

The Field of the Invention

The present invention relates generally to the field of interactive television systems. More specifically, the present invention relates to an interactive companion set top box (STB) that may be used in combination with a conventional STB to provide Internet access and other enhanced features, such as Video-on-Demand (VoD), Personal Video Recording (PVR), an Electronic Programming Guide (EPG), and videoconferencing.

Technical Background

In the context of a cable television (CATV) network, a set top box (STB) is a device that selectively receives and decodes television signals for display on an external display device, such as an attached television set. In general, an STB includes a video tuner for receiving television signals on a selected frequency (e.g., channel). Often, the signals are encoded to limit access to legitimate subscribers using a technique called conditional access (CA). Thus, an STB also typically includes CA hardware for decoding/decrypting the signals when the subscriber is authorized to receive them.

Advances in signal encoding have led to the use of digital compression techniques for delivering television programs via a CATV network. Digital compression increases channel capacity over existing cable infrastructures and improves video and audio quality. The most common digital compression format is MPEG (Moving Picture Experts Group), variants of which include MPEG-1, MPEG-2, MPEG-4, MPEG-7, and the like.

In recent years, a new generation of "digital" STBs has been developed for receiving digitally-compressed signals. Examples of such digital STBs include the Motorola DCT 2000® STB and the Scientific Atlantic Explorer 3000® STB. The Motorola DCT® series STB is believed to be the world's most widely deployed digital STB, with more than 5 million units in consumer homes.

Unfortunately, with the rapid advancement of new technologies, particularly in the area of the Internet, earlier-generation digital STBs are being threatened with obsolescence. For example, in order to provide Internet access or VoD, a STB requires a cable modem, such as a DOCSIS (Data Over Cable Service Interface Specification) modem.

Cable system operators (MSOs) have invested substantial capital in earlier-generation digital STBs that do not include cable modems. MSOs are now confronted by satellite television providers that offer Internet access and other new forms of interactivity, such as VoD. To be competitive, MSOs need to find a fast and relatively inexpensive way to add Internet access and interactivity without replacing the installed base of digital STBs.

Earlier-generation STBs also do not incorporate certain enhanced features, such as personal video recording (PVR). Examples of PVR systems include TiVo® and ReplayTV®. MSOs would also like to provide such capabilities without having to replace the installed base of earlier-generation digital STBs.

Accordingly, it would be an advancement in the art to provide a system and method for enabling Internet access and other advanced features for existing digital STBs, without requiring expensive upgrades or retrofitting.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-exhaustive embodiments of the invention are described with reference to the figures, in which:

FIG. 1 is a schematic block diagram of a standard set top box (STB);

FIG. 2 is a schematic block diagram of a standard STB interfaced with a first embodiment of an interactive companion STB;

FIG. 3 is a schematic block diagram of an alternative embodiment of a companion STB including a sensor for detecting a channel change;

FIG. 4 is a schematic block diagram of an alternative embodiment of a companion STB including an integrated microphone, speaker, and video camera; and

FIG. 5 is a schematic block diagram of an alternative embodiment of a companion STB in which a microphone, speaker, and video camera are integrated with a remote control device for the companion STB.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is directed to an interactive "companion" STB that may be used in conjunction with a standard STB, such as the Motorola DCT 2000®, to provide Internet access and other enhanced features, such as VoD, PVR, and the like. In one implementation, the companion STB is a "piggyback" device that interfaces with a standard STB.

Preferably, the companion STB relies upon the video tuner of the standard STB for tuning to a selected channel. Thus, the companion STB need not include a video tuner of its own. In addition, the companion STB relies, in one embodiment, on the conditional access (CA) features of the conventional STB for authorized reception of certain channels, such as premium (e.g., HBO©) and pay-per view (PPV) channels. Accordingly, the companion STB need not include CA hardware.

Preferably, the companion STB includes a cable modem, such as a DOCSIS modem, for providing access to a communication network, such as the Internet. In alternative embodiments, the companion STB may include a DSL (digital subscriber line) or other type of modem. Preferably, the companion STB includes middleware and various client modules to facilitate Web browsing, e-mail, and the like.

The companion STB may also provide personal video recording (PVR) functionality, such as scheduled recording of television programs, automatic recording of television programs based on specified and observed user preferences, pausing (buffering) "live" video and the like. To accomplish this,

the companion STB includes a storage device, such as a hard disk drive, as well as encoding/decoding hardware and software, including electronic programming guide (EPG) software.

Further, the companion STB may include a microphone and/or digital video camera for facilitating two-way communication (e.g., teleconferencing or videoconferencing) with similarly equipped users. The microphone and/or digital video camera may be integrated with the companion STB, itself, or with a remote control device for the companion STB. These and other advantages and features of the present invention will be more apparent from the following discussion provided.

Reference throughout this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the present invention. Thus, the appearances of the phrases "in one embodiment" or "in an embodiment" in various places throughout this specification are not necessarily all referring to the same embodiment.

Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments. In the following description, numerous specific details are provided, such as examples of software modules, user interfaces and commands, network interfaces, hardware components, etc., to provide a thorough understanding of embodiments of the invention. One skilled in the relevant art will recognize, however, that the invention can be practiced without one or more of the specific details, or with other methods, components, materials, etc. In other instances, well-known structures, materials, or operations are not shown or described in detail to avoid obscuring aspects of the invention.

Throughout the following disclosure, the term "coupled" may be used to refer to components that are either in direct communication or linked by one or more other components. Thus, as used herein, the term "coupled" may be synonymous with "in electrical communication with" or simply "in communication with."

Referring to FIG. 1, there is shown a standard STB 102 that may interface with a companion STB of the present invention. One of skill in the art will appreciate that FIG. 1 illustrates basic components of a standard STB 102 and is not intended to be an exhaustive description thereof. Various details known to those skilled in the art have been omitted for purposes of clarity.

The standard STB 102 typically includes an RF input 104, such as CATV "F" connector, for coupling the standard STB 102 to a head-end or other distribution node of a CATV network (not shown). The RF input 104 is in electrical communication with a standard video tuner 106, which selectively receives a signal ranging in frequency, for example, from 50 to 860 Mhz.

In the context of a digital STB, the signal includes a modulated/multiplexed digital media stream, such as an MPEG (Moving Picture Experts Group) stream. The digital media stream may include a number of discrete audio/video "channels," which may be selected by a user by means of remote control device (not shown).

The video tuner 106 is coupled, in one implementation, to a demodulator/demultiplexer 108, which demodulates the signal and selects a particular audio/video channel for decoding by a decoder 110. The decoder 110 may be embodied as a standard MPEG-2 decoder, which is well known in the art. The decoder 110 is typically a special-purpose hardware unit that is able to provide relatively high frame rates when compared to software decoding by a general-purpose microprocessor.

The decoder 110 may also be configured to perform conditional access (CA) functions, such as limiting access to premium and pay-per-view (PPV) channels to subscribers who have paid for such services. For example, in one embodiment, the decoder 110 may be configured to decrypt an encrypted digital media stream. In alternative embodiments, a separate decryption hardware unit may be used. CA techniques are well known in the CATV art and will not be discussed in detail here.

Typically, the standard STB 102 includes an audio/video (A/V) controller 112 that is in electrical communication with the decoder 110 to

receive the decoded television signal. The A/V controller 112 provides audio/video output suitable for reception by a television set or a recording device, such as a VCR.

In some cases, the A/V controller 112 includes graphics hardware for performing bit-block transfers (bit-blits) and the like. Thus, the A/V controller 112 may be configured to display a graphical user interface (GUI) including menus, icons, selectable controls, and the like. The GUI may be displayed separately or simultaneously with the television signal.

The A/V controller 112 may be coupled an RF output 114, such as a CATV "F" connector. In such an embodiment, the A/V controller 112 includes a remodulator for generating a modulated television signal on a particular channel, typically channel 3 or 4. Alternatively, the A/V controller 112 may be coupled to a composite (RCA-type) video output 116, as well as left and right (stereo) audio outputs 118, 120. Of course, other types of outputs may be provided, such as S-Video, SPDIF, etc.

In general, the standard STB 102 includes a channel indicator 122 for indicating the CATV channel being currently received by the video tuner 106. The channel indicator 122 may be embodied, for instance, as three, seven-segment LED or LCD arrays for displaying channel numbers ranging from 0 to 999.

The standard STB 102 also typically includes an IR (infrared) receiver 124 for receiving commands from a remote control device (not shown). Such commands may be used to instruct the standard STB 102 to change channels, order pay-per-view (PPV) programming, and the like. Of course, other wireless technologies may be used, such as RF (radio frequency) or the like.

The standard STB 102 also includes a central processing unit (CPU) 126, such as a microprocessor, digital signal processor (DSP), or the like. The CPU 126 executes software programs stored in a memory 128 to perform various tasks, such as displaying a GUI, processing commands received from a remote control device, and the like. The CPU 126 controls the operation of the standard STB 102, including the various components and functions

thereof. The standard STB 102 may further include a bus 130 to facilitate communication between the CPU 126 and various other components of the standard STB 102.

Referring now to FIG. 2, a first embodiment of a companion STB 202 is shown in electrical communication with a standard STB 102, such as a Motorola DCT 2000®. In one embodiment, a composite video output 116 of the standard STB 102 is coupled to a composite video input 204 of the companion STB 202. Likewise, left and right audio outputs 118, 120 of the standard STB 102 are coupled to left and right audio inputs 206, 208 of the companion STB 202. Such couplings may be easily performed by a end-user by means of conventional cabling. In alternative embodiments, the companion STB 202 may include other types of inputs, such as an S-Video input 207 or an SPDIF input 209, for coupling the companion STB 202 to the standard STB 102.

In one implementation, the companion STB 202 is also in communication with the standard STB 102 via a remote control simulator 210, such as an IR Blaster™, available from Sunbelt Industries Technologies Group, Inc. An IR Blaster™ includes an infrared (IR) transmitter that simulates a remote control device by generating IR commands for reception an IR receiver 124 of the standard STB 102. The remote control simulator 210 may be attached via a wire to the companion STB 202, allowing it to be placed in close proximity to the IR receiver 124. In an alternative configuration, a wireless remote control simulator 210 may be used.

In operation, the remote control simulator 210 receives electrical signals from the companion STB 202 and generates corresponding IR commands for reception by the IR receiver 124. Using the remote control simulator 210, for example, the companion STB 202 may instruct the standard STB 102 to change channels, order pay-per-view (PPV) programming, or to perform any other function that may be accessed by a remote control device for the standard STB 102. Thus, only a single remote control device may be required for operating both the companion STB 202 and the standard STB 102.

The remote control simulator 210 may also include an IR receiver configured to receive IR signals from the remote control device in order to "learn" which IR signals correspond to various commands. Mappings between IR signals and commands may be stored in a memory of the companion STB 202 or of the remote control simulator 210, itself. Of course, a basic set of commands may be pre-programmed for the particular type of standard STB 102 in operation.

The use of a remote control simulator 210 provides the companion STB 202 with effective control over the standard STB 102, without requiring expensive upgrades or retrofits. One advantage of the present invention is that an end-user may easily interface the companion STB 202 with the standard STB 102 without the assistance of a CATV technician or the need to modify the standard STB 102 in any manner.

In one implementation, the companion STB 202 includes an NTSC decoder/ADC 209, coupled to the inputs 204, 206, 208, which decodes a composite television signal received from the standard STB 102 and converts the same into a digital signal using techniques well known in the art. Outside of the United States, a PAL or SECAM decoder may be provided.

The digital signal may be sent to an A/V controller 212, similar to the A/V controller 112 of the standard STB 102, for generating an output signal for an external display or recording device, such as a TV or VCR. In one embodiment, the A/V controller 212 is coupled to an RF output 214 and/or a composite video output 216 and left/right audio outputs 218, 220, although other outputs may be provided, such as an S-Video output 217 and an SPDIF output 219.

The companion STB 202 may also include an encoder 222, such as an MPEG-2 encoder, for converting the digital signal into an digital media stream. Various single-chip MPEG-2 encoding solutions are available from manufacturers such as Fujitsu, IBM, VisionTech, and the like. Of course, other video compression standards exist, such as JPEG, JPEG-LS, H.261, and H.263. Thus, the invention should not be construed as being limited only to MPEG.

In certain embodiments of the invention, the digital media stream may be sent via a bus 224 to a storage interface 226, where it may be stored in a storage device 228, such as a hard disk drive. As described in greater detail below, the storage device 228 may be used to provide personal video recording (PVR) functionality, such as scheduled recording of television programs, automatic recording of television programs based on specified and observed user preferences, pausing (buffering) live video, and the like.

A stored digital media stream may be retrieved from the storage device 228 by the storage interface 226 and sent via the bus 224 to a decoder 230, such as an MPEG-2 decoder. The decoder 230 then decodes the digital media stream into a digital signal of a format compatible with the A/V controller 212. Various single-chip MPEG-2 decoding solutions are available from VisionTech, C-Cube, and other manufacturers.

Preferably, the companion STB 202 includes a cable modem 232 to provide access to a communication network, such as the Internet. This enables access to the World Wide Web (WWW) component of the Internet, Video-on-Demand (VoD) servers, and the like. The cable modem 232 may be in communication with a head-end or other distribution node of the CATV network via an RF input 234. The cable modem 232 may conform to various standards, such as DOCSIS (Data Over Cable Service Interface Specification) or DAVIC (Digital Audio-Visual Council). In alternative embodiments, a DSL (digital subscriber line) modem may be provided. The CATV network is preferably in communication with the Internet, VoD servers, and other content sources.

The cable modem 232 demodulates an analog signal received from the CATV network to generate a digital signal for use by the companion STB 202. Likewise, the cable modem 232 modulates a digital signal from the companion STB 202 to create an analog signal for transmission via the CATV network. While the cable modem 232 is illustrated as being disposed within the companion STB 202 (e.g., on a PCB for the STB 202), an external cable modem 232 may be provided in other embodiments.

The companion STB 202 further includes a CPU 236 that is in electrical communication with the other components of the companion STB 202 via the bus 224. The CPU 236 may be embodied in various forms, such as microcontroller, a microprocessor (e.g., an Intel® x86 processor), a digital signal processor (DSP) or other device known in the art. The CPU 236 performs logical and arithmetic functions under control of software stored in a memory 238. In one embodiment, the software is loaded into the memory 238 from the storage device 228 prior to execution.

In one configuration, the CPU 236 manages network protocols, such as TCP/IP (Transmission Control Protocol/Internet Protocol), to allow communication via the Internet. IP packets received via the cable modem 232 may include digital media streams, such as MPEG streams. Such digital media streams may be stored within the storage device 228 or sent via the bus 224 to the decoder 230 for output by the A/V controller 212.

In one embodiment, the memory 238 stores a number of software modules. For example, the memory 238 may include an operating system (OS) 240, such as Linux® or Windows CE®, which manages and provides system resources to the other software modules described herein. The OS 240 preferably includes code for displaying a graphical user interface (GUI) to facilitate interaction with a user.

The memory 238 may include various combinations of volatile memory, such as random access memory (RAM), and non-volatile memory, such as read-only memory (ROM). For example, certain software modules may be loaded from the storage device 228 into RAM, while other software modules are pre-loaded into a flash programmable ROM.

Additionally, the memory 238 may include middleware 242, such as Liberate®, to facilitate seamless interaction between the software modules described below. The Liberate® platform combines Internet content standards such as HTML (HyperText Markup Language), JavaScript, and Java with digital television standards, including DVB and ATSC. Additionally, Liberate® integrates TV-based applications such as Electronic Program Guides (EPGs) and Video-on-Demand (VoD).

In one embodiment, the memory 238 further includes a Web module 244, such as a Web browser, for providing access to the World Wide Web (WWW) component of the Internet. Various Web modules 244 may be used, examples of which include Microsoft Internet Explorer®, Netscape Navigator®, and the like. Web browsers rely on HTTP (HyperText Transfer Protocol) and other standard protocols to retrieve and display content hosted on Internet-based servers.

Similarly, the memory 238 may include an e-mail module 246, such as Microsoft Outlook® or Eudora®. The e-mail module 246 allows a user of the companion STB 202 to send and receive e-mail messages using standard e-mail protocols, such as SMTP (Simple Mail Transfer Protocol), IMAP (Internet Message Access Protocol), and POP (Post Office Protocol).

In one embodiment, the memory 238 includes an EPG (electronic programming guide) module 248. An EPG is a listing of television programs available via CATV network for a period of time and is typically arranged in a grid configuration with axes corresponding to channels and time slots. Programming information for the EPG may be retrieved by the EPG module 248 from the CATV network or the Internet using the cable modem 232. Techniques for generating an EPG are well known in the art, an example of which is shown in U.S. Patent No. 5,532,754, for "Background Television Schedule System," which is incorporated herein by reference.

As noted earlier, the companion STB 202 includes a storage device 228 for storing digital media streams. In one embodiment, the memory 238 includes a personal video recording (PVR) module 250 for providing PVR functionality, such as scheduled recording of television programs (e.g., digital media streams), automatic recording of television programs based on specified and observed user preferences, and pausing (buffering) live video. The PVR module 250 is also responsible for retrieving a user-selected digital media stream from the storage device 225 for decoding and presentation to the user.

A number of PVR systems are known in the art, such as TiVo® and ReplayTV®. Preferably, the PVR module 250 is seamlessly integrated with

the EPG module 248, such that a user may select a television program from the EPG for scheduled recording by the PVR module 250.

In various embodiments, the memory 238 may include a Video-on-Demand (VoD) module 252 for receiving VoD programming. VoD is an umbrella term for a wide set of technologies with a common goal of enabling individuals to select videos from a central server for viewing on a television or computer screen. VoD can be used for entertainment (ordering movies transmitted digitally), education (viewing training videos), and videoconferencing (enhancing presentations with video clips). Digital video streams may be compressed using standard protocols, such as MPEG-2, and broadcast using various infrastructures, such as a broadband CATV network, a satellite (DSS) network, or the like.

Of course, various other software modules may be included within the memory 238 for providing additional features and functionality not found in a standard STB 102. In alternative embodiments, any of the above-described software modules may be implemented in hardware and firmware using conventional techniques.

In the depicted embodiment, the companion STB 202 also includes an IR receiver 254 for receiving IR command signals from a remote control device (shown in FIG. 5). In one embodiment, only a single remote control device is needed for both the companion STB 202 and the standard STB 102, since the remote control simulator 210 of the companion STB 202 sends any necessary IR commands to the IR receiver 124 of the standard STB 102. In alternative embodiments, other wireless receivers may be used, such as radio frequency (RF) receivers. The companion STB 202 may further include a channel indicator 256, similar to the channel indicator 124 of the standard STB 102, to indicate the currently selected channel.

Referring now to FIG. 3, an alternative embodiment of the companion STB 202 is depicted as including an external sensor 302 for reading or detecting a change in the channel indicator 124 of the standard STB 102. One of the difficulties with standard remote control simulators 210, such as the IR Blaster^{tm}, is that, for various reasons, an IR command may not be

successfully transmitted to the standard STB 102. Unfortunately, if the companion STB 202 incorrectly assumes, for example, that the standard STB 102 has changed channels, the STB 202 could record the wrong programming.

In one embodiment, the sensor 302 provides a feedback mechanism to indicate to the companion STB 202 which channel is being displayed by the standard STB 102, or at least whether a channel change has occurred. Accordingly, the companion STB 202 may retransmit an IR command to the standard STB 102 the original command was not successfully received.

In one configuration, the sensor 302 is placed by an end-user over the channel indicator 124 of the standard STB 102. The sensor 302 preferably includes an array of photo-sensitive elements, allowing it to read the channel displayed by the channel indicator 124. Alternatively, the sensor 302 may be configured to determine merely whether the channel has been changed. In one embodiment, this is accomplished by detecting a change in luminosity over the entire channel indicator 124 or one or more segments thereof.

In an alternative embodiment, the companion STB 202 may be configured to detect a channel change (or the current channel) based upon information encoded within the vertical blanking interval (VBI) of the television signal received from the standard STB 102. In still other embodiments, the companion STB 202 may be configured to detect a channel change from information encoded within a digital media stream.

FIG. 4 illustrates another embodiment of the companion STB 202 in which a microphone 402, speaker 404, and optional video camera 406 are included for facilitating teleconferencing and/or videoconferencing. For example, the microphone 402 may capture an audio signal and transmit the same via the cable modem 232 to a similarly-equipped user at a different location.

Likewise, the companion STB 202 may receive an audio signal from another user and reproduce the signal on a television and/or the speaker 404.

The camera 406 may be embodied as a color or monochromatic digital video camera, which includes a progressive scan charged coupled device

(CCD) array to deliver digital video of up to, or greater than, 320 x 240 pixels in 24-bit color, with 30 frames per second (NTSC) or 25 frames per second (PAL). Furthermore, the camera 406 may include an optical or digital zoom, as well as automatic white balance and automatic exposure features to adjust for lighting and scene content.

The camera 406 may also be used to capture still pictures. Such still pictures may be stored in JPEG, TIFF, GIF, or other standard image formats. The resolution of the camera 406 when used to capture still pictures may be greater than the resolution of captured video. Still pictures may be stored in the storage device 228 or sent via the cable modem 232 to users equipped to view the same.

In one embodiment, video and audio signals captured by the camera 406 and microphone 402, respectively, are digitized by an ADC 408 and converted into a digital media stream by the encoder 222 before being sent via the cable modem 232 or stored within the storage device 228. Likewise, digital media streams received by the cable modem 232 may be decoded by the decoder 230 before storage in the storage device 228 or processing and output by the A/V controller 212.

In order to facilitate video/teleconferencing, the memory 238 may include a video/teleconferencing module 410. A number of video/teleconferencing systems are known in the art, such as Microsoft Netmeeting®, CUseeMe®, and the like. The video/teleconferencing module 410 may rely on various standard protocols, such as VoIP (Voice over IP) and MPEG to send and receive digital media streams via the cable modem 232. For example, audio and video signals captured by the companion STB 202 may be encoded by the video/teleconferencing module 410 using the MPEG format before being sent as digital media streams via the cable modem 232. Likewise, digital media streams received via the cable modem 232 may be decoded by the video/teleconferencing module 410 for presentation to a user. The video/teleconferencing module 410 may utilize the hardware encoder 222 and decoder 230 in certain implementations.

In an alternative embodiment, as shown in FIG. 5, the microphone 402, speaker 404, and optionally, the video camera 406, may be integrated with a remote control device 502 for the companion STB 202. The remote control device 502 may include a radio frequency (RF) transceiver 504 for transmitting a captured audio/video signal to a similar RF transceiver 504 within the companion STB 202. Of course, other wireless transmission techniques may be used, such as IR, VHF, UHF, and the like.

The RF transceiver 504 preferably modulates the video and/or audio information with a carrier frequency to enable transmission thereof to the companion STB 202 using techniques well known in the art. For example, the RF transceiver 504 may operate according to the IEEE 802.11a or 802.11b Wireless Networking standards, the "Bluetooth" standard, or according to other standard or proprietary wireless techniques. Although not illustrated, the RF transceiver 504 may include analog-to-digital (ADC) and digital-to-analog (DAC) converters, as well as other standard components, such as antennas, amplifiers, and the like.

Additionally, the RF transceiver 504 of the remote control 502 may be configured to receive information from the RF transceiver 504 of the companion STB 202. For example, an audio signal may be received from the companion STB 202 and reproduced via the speaker 404. Thus, teleconferencing using the remote control device 502 is enabled.

The remote control device 502 may further include an IR transmitter 508 for transmitting IR commands to the IR receiver 254 of the companion STB 202 in order to control the operation of the same. However, those skilled in the art will recognize that the remote control device 502 may use other wireless technologies without departing from the spirit and scope of the invention.

In one embodiment, the RF transceiver 504 of the companion STB 202 is coupled to the bus 224, providing access to the encoder 222. In one embodiment, a captured video/audio signal is encoded via the encoder 222 before being transmitted by the cable modem 232 or stored in the storage device 228.

As shown in FIG. 5, the companion STB 202 may further include a smart card interface 510 to allow read/write operations with an integrated circuit (IC) card, sometimes referred to as a "smart" card. Smart cards are capable of storing and executing instruction code and have greater memory capacity than conventional magnetic strip cards. Smart cards are currently becoming popular in e-commerce transactions, since they can be used to store cryptographic keys, digital "cash," and the like. Smart cards are also being used to store pictures, audio clips, and software updates. Thus, the inclusion of a smart card interface 510 in the companion STB 202 enhances a standard STB 102 with a number of features, without replacement or retrofitting.

The companion STB 202 may be further embodied with additional interface devices and/or ports (not shown). For example, the companion STB 202 may be embodied with one or more USB (universal serial bus) ports 512, serial and/or parallel communication ports 514 for interfacing with peripheral devices, such as scanners, printers, facsimile machines, cradles for personal digital assistants (PDAs) and so forth.

In one configuration, the companion STB 202 includes a network port 516, such as an RJ45 connector, with such standard network interface circuitry (not shown) for coupling the companion STB 202 to an Ethernet or other communication network. Similarly, the companion STB 202 may be further embodied with a telephone port 518, such as an RJ11 connector, with such standard telephony circuitry (not shown) for coupling the companion STB 202 to a telephone network.

In view of the forgoing, the present invention offers numerous advantages not available in the conventional approaches. For example, the companion STB 202 enhances a standard STB 102 with a number of features, such as Internet access, e-mail, EPG, PVR, VoD, video/teleconferencing, and smart card access, without requiring replacement or retrofitting of the standard STB 102 or even servicing by a CATV professional. Interfacing the companion STB 202 with the standard STB may be easily performed by an end-user. Accordingly, the useful life of the

standard STB 102 is extended, resulting in a significant cost savings to MSOs.

While specific embodiments and applications of the present invention have been illustrated and described, it is to be understood that the invention is not limited to the precise configuration and components disclosed herein. Various modifications, changes, and variations which will be apparent to those skilled in the art may be made in the arrangement, operation, and details of the methods and systems of the present invention disclosed herein without departing from the spirit and scope of the invention.

What is claimed is:

1. A companion device for enhancing a television set top box including a video tuner for receiving a video signal on a selected channel, the companion device comprising:

a processor;

a memory coupled to the processor for storing program instructions;

a video input coupled to an output of the set top box for receiving a first video signal;

a video output coupled to the video input for delivering the first video signal to an external display device;

a cable modem, under control of the processor, for sending and receiving information via a communication network; and

a display controller coupled to the video input and the video output for sending a second video signal, including information received from the communication network, to the video output for display by the external display device.

2. The companion device of claim 1, wherein the cable modem comprises a Data Over Cable Service Interface Specification (DOCSIS) modem.

3. The companion device of claim 1, wherein the communication network comprises the Internet.

4. The companion device of claim 1, wherein the external display device comprises a television.

5. The companion device of claim 1, wherein the display component is further configured to combine the first and second video signals for simultaneous display thereof by the external display device.

6. The companion device of claim 1, further comprising:

a remote control simulator, coupled to the processor, for transmitting at least one command to the set top box simulating a command sent by a remote control device for the set top box.

7. The companion device of claim 6, wherein the at least one command is configured to change the selected channel.

8. The companion device of claim 6, wherein the remote control simulator comprises a infrared (IR) transmitter configured to transmit an IR-based command to a receiver within the set top box.

9. The companion device of claim 6, further comprising:

a sensor, coupled to the processor, configured to detect a change in the selected channel.

10. The companion device of claim 9, wherein the sensor comprises a photo-sensitive array disposed over a channel indicator on the set top box.

11. The companion device of claim 9, wherein the sensor is further configured to determine the selected channel.

12. The companion device of claim 8, wherein the processor is further configured to instruct the remote control simulator to retransmit a command in response to the sensor not detecting a change in the selected channel after a prior transmission of the command.

13. The companion device of claim 1, wherein the memory comprises a Web browsing module configured to retrieve user-selected information from the communication network for output via the display controller.

14. The companion device of claim 1, further comprising:

an encoder, coupled to the processor, for encoding the first video signal into a digital media stream.

15. The companion device of claim 14, wherein the digital media stream comprises a Moving Picture Experts Group (MPEG) stream.

16. The companion device of claim 14, further comprising:

a storage device, coupled to the encoder, for storing the digital media stream.

17. The companion device of claim 16, wherein the memory comprises a recording module configured to record a digital media stream in the storage device corresponding to a user-selected television program.

18. The companion device of claim 17, further comprising:

a decoder, coupled to the processor, for decoding a digital media stream into a video signal for output by the display controller, wherein the recording module is further configured to retrieve a user-selected digital media stream from the storage device for decoding and presentation to a user.

19. The companion device of claim 1, further comprising:

a decoder, coupled to the processor, for decoding a digital media stream received from the cable modem into a video signal for output by the display controller.

20. The companion device of claim 1, wherein the memory comprises an e-mail module configured to send and receive e-mail messages via the cable modem.

21. The companion device of claim 1, wherein the memory comprises an electronic programming guide (EPG) module configured to

receive television program schedule information from a remote database via the cable modem and format the information into an EPG for output by the display controller.

22. The companion device of claim 1, wherein the memory comprises a Video-on-Demand (VoD) module configured to receive a digital media stream corresponding to a user-selected entertainment program from a remote server via the cable modem for decoding and presentation to a user.

23. The companion device of claim 1, further comprising:

a microphone, coupled to the processor, for capturing an audio signal, wherein the memory comprises a teleconferencing module configured to encode the audio signal into a digital media stream for transmission via the cable modem.

24. The companion device of claim 1, wherein the memory comprises a teleconferencing module configured to receive a digital media stream from the cable modem and decode the digital media stream into an audio signal for playback by the external display device.

25. The companion device of claim 1, wherein the memory comprises teleconferencing module configured to receive a digital media stream from the cable modem and decode the same into an audio signal, the companion device further comprising:

a speaker, coupled to the processor, for generating audible output from the decoded audio signal.

26. The companion device of claim 1, further comprising:

a video camera, coupled to the processor, for capturing a video signal, wherein the memory comprises a videoconferencing module configured to encode the video signal into a digital media stream for transmission via the cable modem.

27. The companion device of claim 1, wherein the memory comprises a videoconferencing module configured to receive a digital media stream from the cable modem and decode the same into a video signal for display on the external display device.

28. The companion device of claim 1, further comprising:

a wireless receiver, coupled to the processor, for receiving an audio signal from a remote control device, wherein the remote control device comprises a microphone configured to capture the audio signal.

29. The companion device of claim 1, further comprising:

a wireless receiver, coupled to the processor, for receiving a video signal from a remote control device, wherein the remote control device comprises a video camera configured to capture the video signal.

30. The companion device of claim 1, further comprising:

a smart card interface, coupled to the processor, configured to read data from, and write data to, a smart card.

31. A method for enhancing a television set top box including a video tuner for receiving a video signal on a selected channel, the method comprising:

providing a video input coupled to an output of the set top box for receiving a first video signal,

providing a video output coupled to the video input for delivering the first video signal to an external display device,

providing a cable modem, under control of the processor, for sending and receiving information via a communication network; and

sending a second signal, including information received from the communication network, to the video output for display by the external display device.

32. The method of claim 31, wherein the cable modem comprises a Data Over Cable Service Interface Specification (DOCSIS) modem.

33. The method of claim 31, wherein the communication network comprises the Internet.

34. The method of claim 31, wherein the external display device comprises a television.

35. The method of claim 31, further comprising:

combining the first and second video signals for simultaneous display thereof by the external display device.

36. The method of claim 31, further comprising:

transmitting at least one command to the set top box simulating a command sent by a remote control device for the set top box.

37. The method of claim 36, wherein the at least one command is configured to change the selected channel.

38. The method of claim 36, wherein the at least one command comprises an infrared (IR) command.

39. The method of claim 36, further comprising:

detecting a change in the selected channel using a sensor.

40. The method of claim 39, wherein the sensor comprises a photo-sensitive array disposed over a channel indicator on the set top box.

41. The method of claim 38, further comprising:

retransmitting a command in response to the sensor not detecting a change in the selected channel after a prior transmission of the command.

42. The method of claim 31, further comprising:

encoding the first video signal into a digital media stream.

43. The method of claim 42, wherein the digital media stream comprises a Moving Picture Experts Group (MPEG) stream.

44. The method of claim 43, further comprising:

storing the digital media stream in a storage device.

45. The method of claim 45, further comprising:

decoding a digital media stream into a video signal for output to the external display device.

46. The method of claim 45, wherein the digital media stream is retrieved from the storage device.

47. The method of claim 45, wherein the digital media stream is received from the cable modem.

48. The method of claim 31, further comprising:

receiving television program schedule information from a remote database via the cable modem; and

formatting the television program schedule information into an electronic programming guide (EPG) for display on the external display device.

49. The method of claim 31, further comprising:

capturing an audio signal using a microphone; and

encoding the audio signal into a digital media stream for transmission via the cable modem.

50. The method of claim 31, further comprising:

receiving a digital media stream from the cable modem;

decoding the digital media stream into an audio signal; and

playing the audio signal on a speaker.

51. The method of claim 31, further comprising:

capturing a video signal using a video camera; and

encoding the video signal into a digital media stream for transmission via the cable modem.

52. The method of claim 31, further comprising:

receiving a digital media stream from the cable modem;

decoding the digital media stream into a video signal; and

outputting the video signal for display on the external display device.

53. A companion device for enhancing a television set top box including a video tuner for receiving a video signal on a selected channel, the companion device comprising:

processing means;

memory means for storing instructions executable by the processing means;

means for receiving a first video signal from the set top box;

means for delivering the first video signal to an external display device;

communication means for sending and receiving information via a communication network; and

display controller means for sending a second video signal, including information received from the communication network, to the delivery means for display by the external display device.

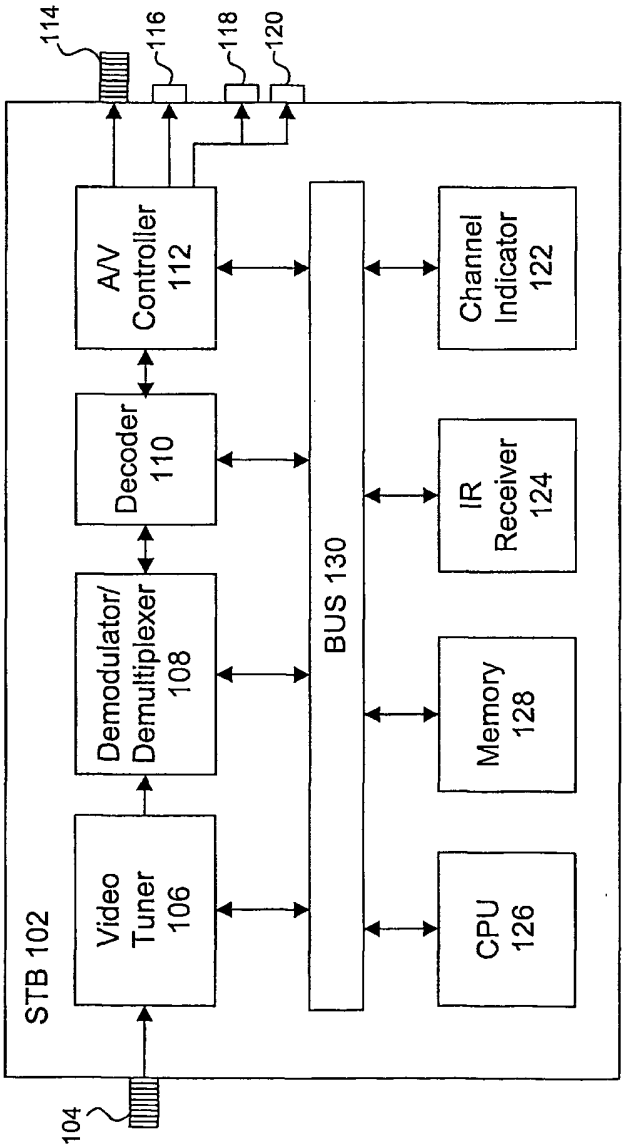
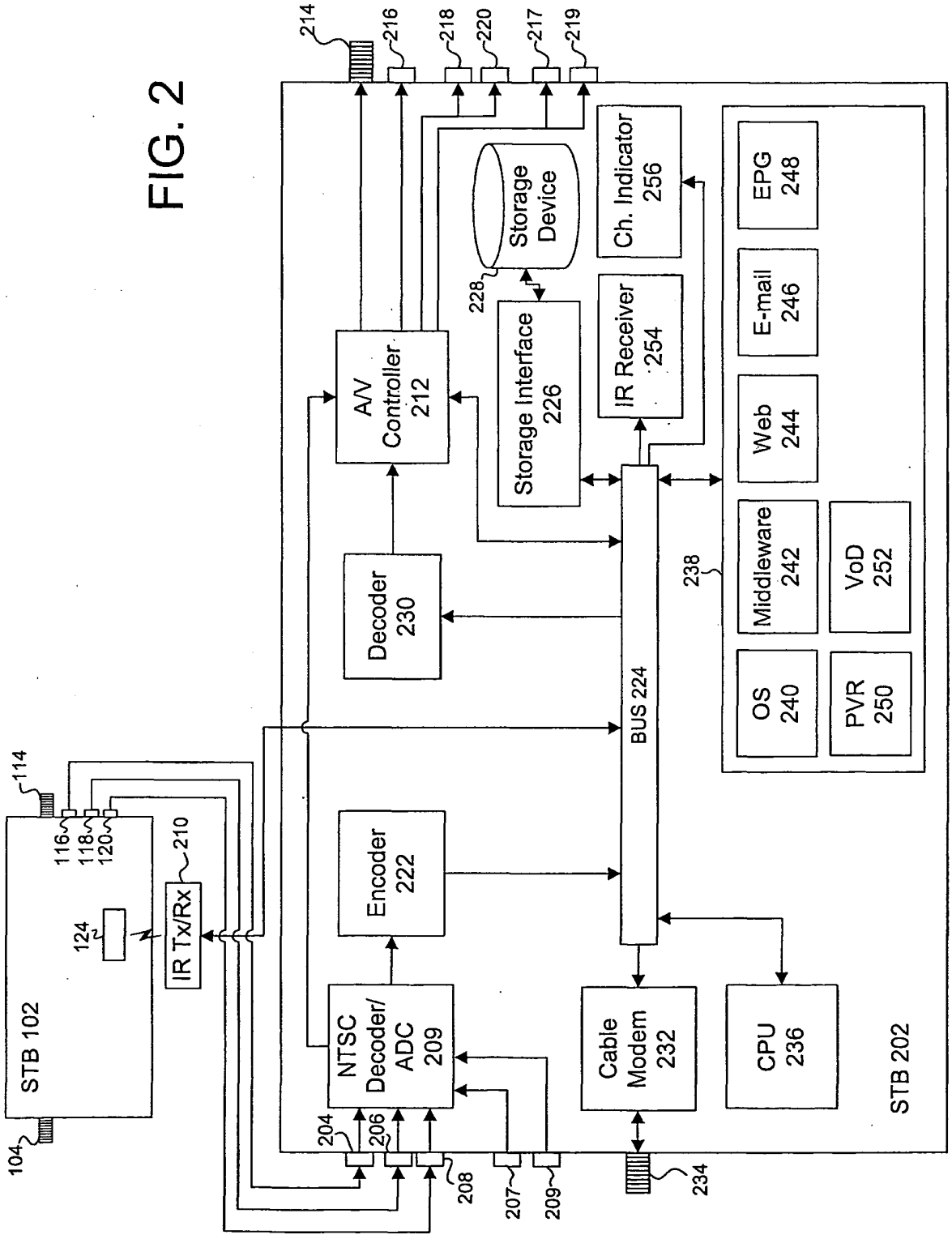


FIG. 1
(Prior Art)

FIG. 2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Storage Device
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EPG 248
E-mail 246
Web 244
Middleware 242
VoD 252
OS 240
PVR 250
238
A/V Controller 212
Storage Interface 226
IR Receiver 254
Decoder 230
BUS 224
Encoder 222
NTSC Decoder/ ADC 209
Cable Modem 232
CPU 236
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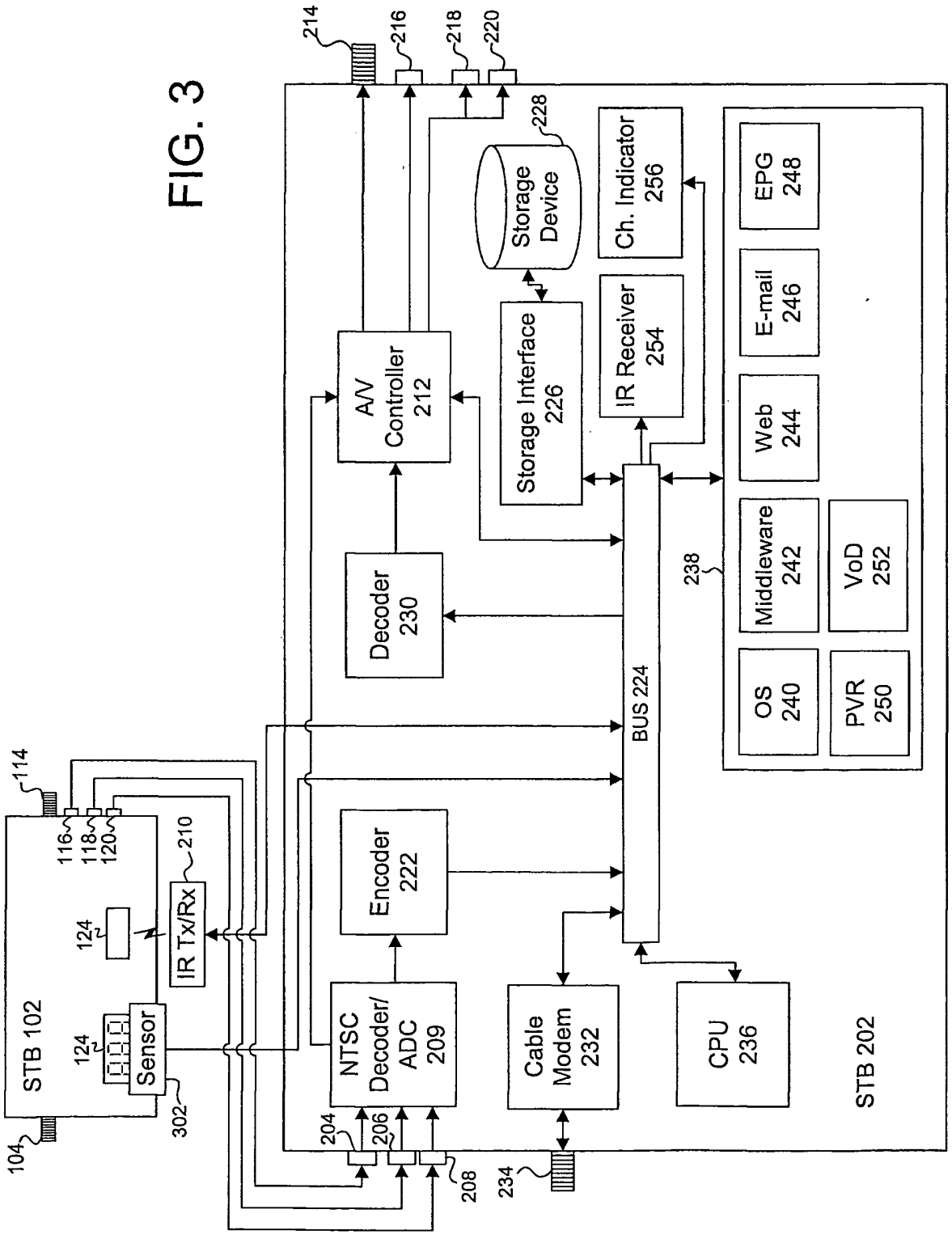
FIG. 3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EPG 248
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A/V Controller 212
Storage Interface 226
IR Receiver 254
Decoder 230
BUS 224
114
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120
210
IR Tx/Rx
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124
Sensor
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STB 102
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Encoder 222
NTSC Decoder/ ADC 209
Cable Modem 232
CPU 236
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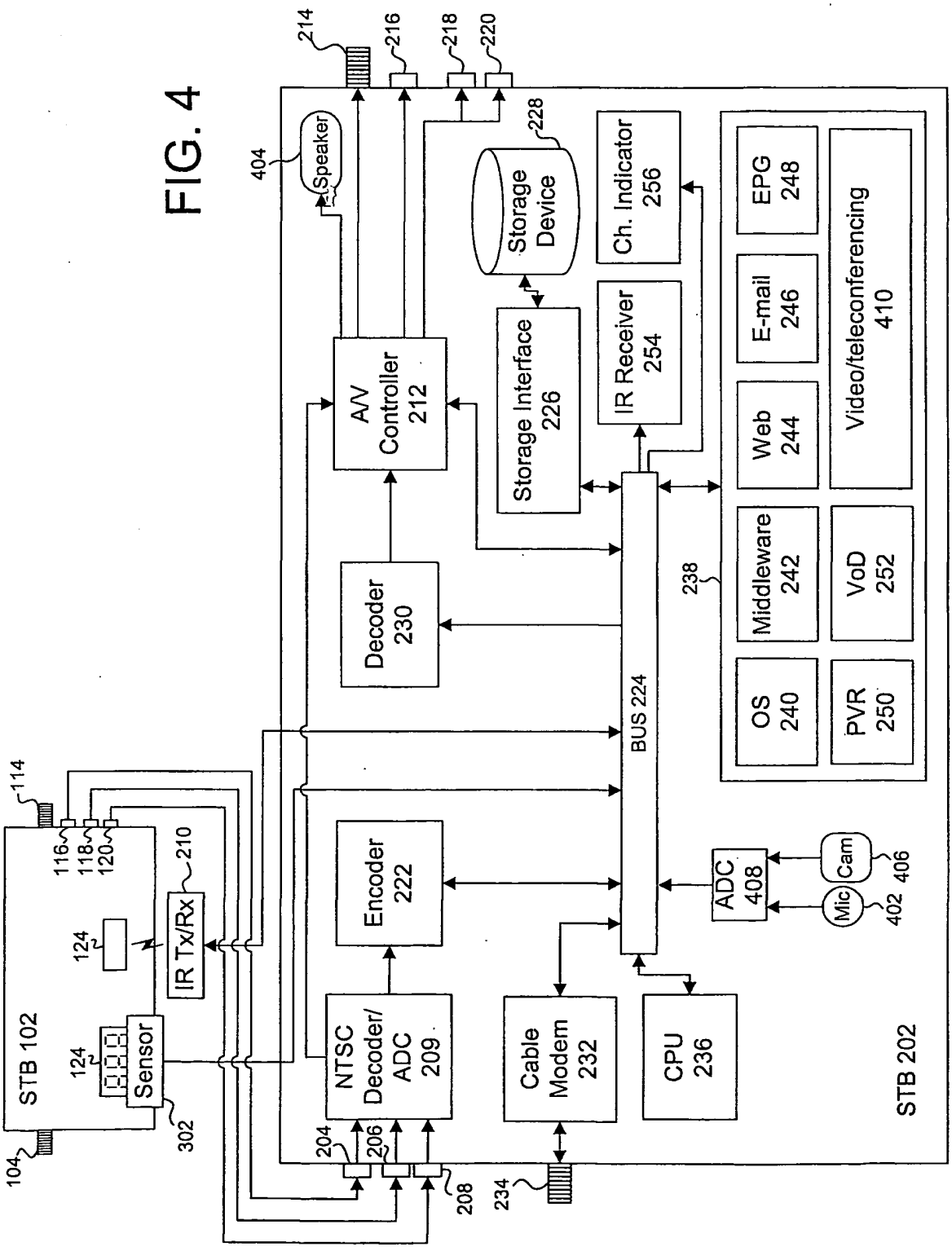
STB 202

FIG. 4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E-mail 246
Video/teleconferencing 410
Web 244
Middleware 242
VoD 252
OS 240
PVR 250
238
A/V Controller 212
Storage Interface 226
IR Receiver 254
Decoder 230
BUS 224
Encoder 222
ADC 408
Cam
Mic
406
402
NTSC Decoder/ ADC 209
Cable Modem 232
CPU 236
IR Tx/Rx
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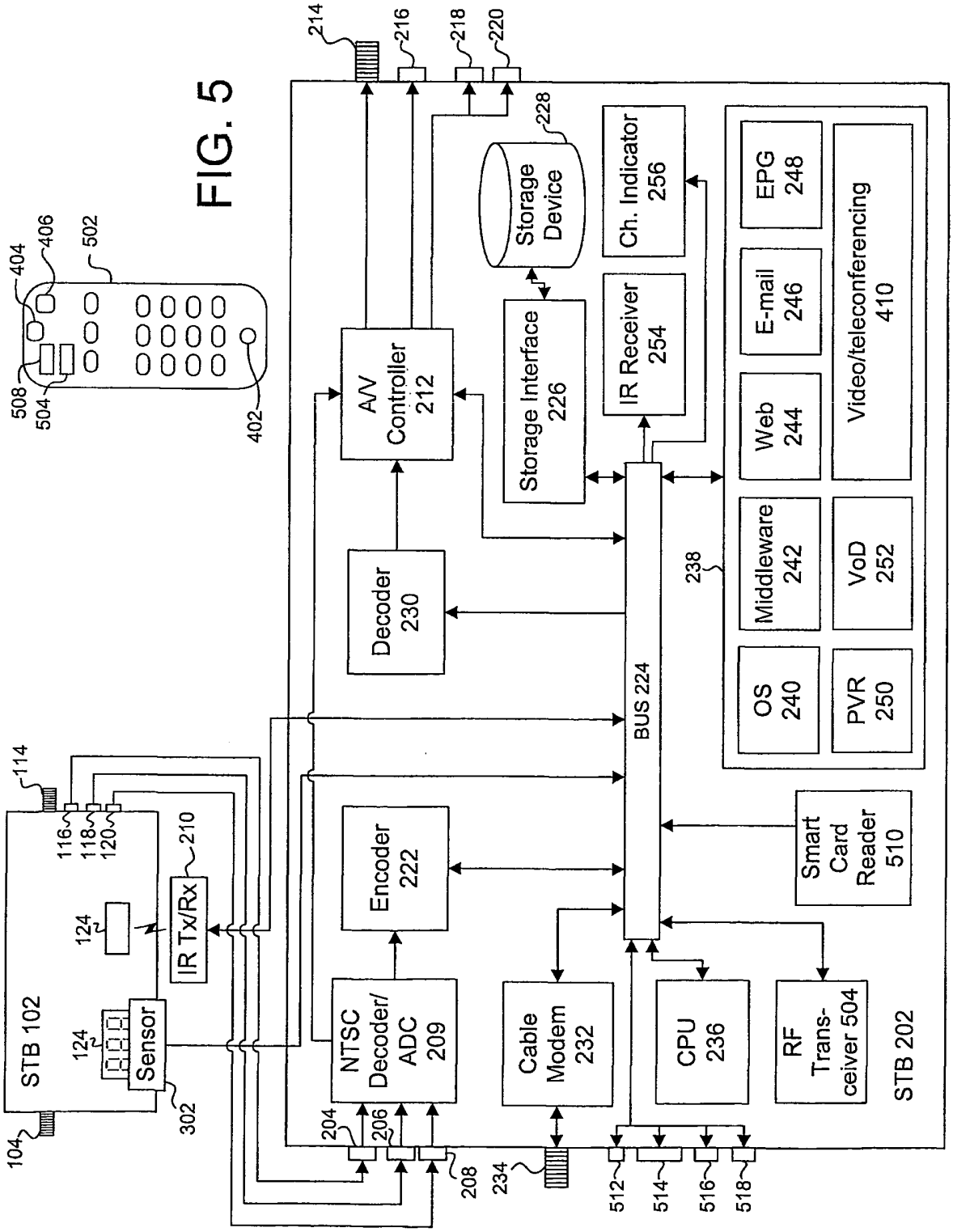
FIG. 5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STB 202
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Encoder 222
Cable Modem 232
CPU 236
RF Trans-ceiver 504
Smart Card Reader 510
BUS 224
Decoder 230
A/V Controller 212
Storage Interface 226
Storage Device
IR Receiver 254
Ch. Indicator 256
OS 240
PVR 250
Middleware 242
VoD 252
Web 244
E-mail 246
EPG 248
Video/teleconferencing 410
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INTERNATIONAL SEARCH REPORT

Int onal application No.
PCT/US01/24068

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H04N 7/00, 7/173, 7/16, 11/00

US CL : 725/131, 133, 139, 140, 141, 151, 152, 153; 348/552

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 725/131, 133, 139, 140, 141, 151, 152, 153; 348/552

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X -- Y	US 5,483,277 A (GRANGER) 09 Jnuary 1996, Fig.2, 3A, 4; Col.2, lines 20-Col3, lines 50	1-53 --- 1-53
Y	US 5,675,390 A (SCHINDLER et al.) 07 October 1997; Fig.1, 3, 5, 7, 14b, 14c, 14d, 15, 16; Col.12, lines 22-55; Col.21, lines 4-36	1-53
Y	US 6,061,719 A (BENDINELLI et al.) 09 May 2000, Fig.3, 4; Col.5, lines 6-56.	13, 31, 32, 33

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date		
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search 21 OCTOBER 2001	Date of mailing of the international search report 19 NOV 2001
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer HAI VAN TRAN Telephone No. (703) 308-0900

Form PCT/ISA/210 (second sheet) (July 1998)★